



A Sierra Monitor Company

Driver Manual
(Supplement to the FieldServer Instruction Manual)

FS-8704-02 BACnet Ethernet

APPLICABILITY & EFFECTIVITY

Effective for all systems manufactured after May 1, 2001

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1. BACnet Ethernet Description

The BACnet Ethernet driver allows the FieldServer to transfer data to and from devices over Ethernet using BACnet Ethernet protocol. The FieldServer can emulate either a Server or Client.

The information that follows describes how to expand upon the factory defaults provided in the configuration files included with the FieldServer.

2. Driver Scope of Supply

2.1. Supplied by FieldServer Technologies for this driver

FieldServer Technologies PART #	Description
FS-8915-10	UTP cable (7 foot) for Ethernet connection
FS-8704-02	Driver Manual

2.2. Provided by the Supplier of 3rd Party Equipment

2.2.1. Hardware

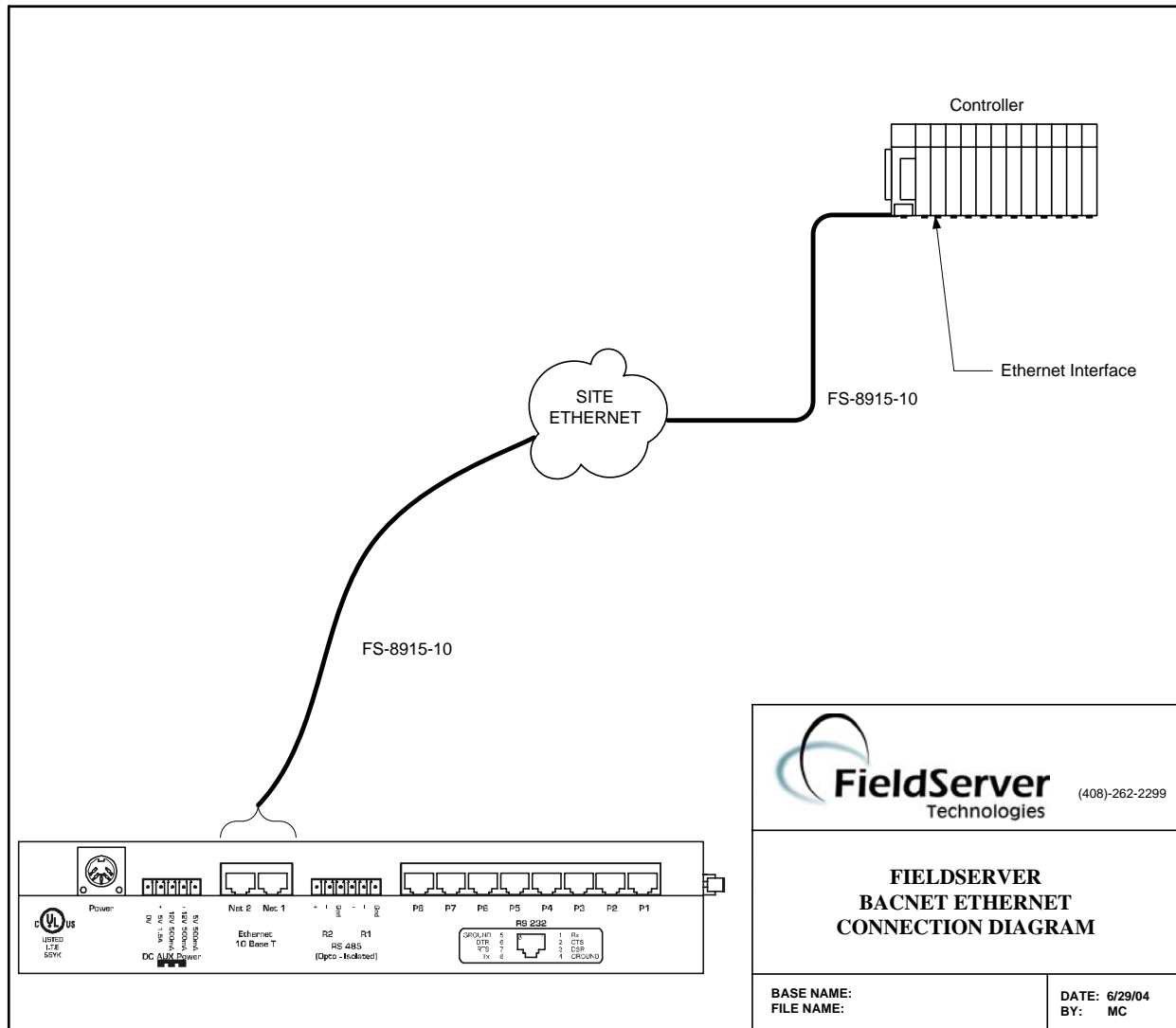
Part #	Description
Trane Building Control Unit (BCU)	Building control unit (BCU) with internal Ethernet adapter.
	Ethernet 10/100 BaseT hub*

* Not all FieldServer models support 100BaseT. Consult the appropriate instruction manual for details of the Ethernet speed supported by specific hardware.

3. Hardware Connections

It is possible to connect a BACnet Ethernet device using the N1 or the N2 network ports. These ports just need to be configured for BACnet Ethernet in the configuration file.

Configure the Controller according to manufacturer's instructions



4. Configuring the FieldServer as a BACnet Ethernet Client

For a detailed discussion on FieldServer configuration, please refer to the FieldServer Configuration Manual. The information that follows describes how to expand upon the factory defaults provided in the configuration files included with the FieldServer (See “.csv” sample files provided with the FieldServer).

This section documents and describes the parameters necessary for configuring the FieldServer to communicate with a BACnet Ethernet Server.

4.1. Data Arrays

Note that in the tables, * indicates an optional parameter, with the bold legal value being the default.

Section Title		
Data_Arrays		
Column Title	Function	Legal Values
Data_Array_Name	Provide name for Data Array	Up to 15 alphanumeric characters
Data_Array_Format	Provide data format. Each Data Array can only take on one format.	FLOAT, BIT
Data_Array_Length	Number of Data Objects. Must be larger than the data storage area required by the Map Descriptors for the data being placed in this array.	1-10,000

Example

// Data Arrays		
Data_Arrays		
Data_Array_Name,	Data_Format,	Data_Array_Length
DA_AI_01,	Float,	200
DA_AO_01,	Float,	200
DA_DI_01,	Bit,	200
DA_DO_01,	Bit,	200

4.2. Client Side Connection Descriptions

Section Title		
Adapter		
Column Title	Function	Legal Values
Adapter	Adapter Name	N1, N2 ¹
Protocol	Specify protocol used	Bacnet_Eth
Poll Delay*	Time between internal polls	0-32000s; 0.500s

¹ Not all ports shown are necessarily supported by the hardware. Consult the appropriate Instruction manual for details of the ports available on specific hardware.

Example

```
// Client Side Connections
Connections
Adapter,          Protocol,          Poll_Delay
N1,              Bacnet_Eth,        0.500s
```

4.3. Client Side Node Descriptors

Section Title		
Nodes		
Column Title	Function	Legal Values
Node_Name	Provide name for node	Up to 32 alphanumeric characters
Node_ID	BACnet station address of physical Server node	1-16777215
Protocol	Specify protocol used	Bacnet_Eth
Adapter	Specify port Adapter used	N1

Example

```
// Client Side Nodes
Nodes
Node_Name,      Node_ID,      Protocol,      Adapter
BCU_01,        1,          Bacnet_Eth,   N1
```

4.4. Client Side Map Descriptors

4.4.1. FieldServer Related Map Descriptor Parameters

Column Title	Function	Legal Values
Map_Descriptor_Name	Name of this Map Descriptor	Up to 32 alphanumeric characters
Data_Array_Name	Name of Data Array where data is to be stored in the FieldServer	One of the Data Array names from "Data Array" section above
Data_Array_Offset	Starting location in Data Array	0 to maximum specified in "Data Array" section above
Function	Function of Client Map Descriptor	RDBC

4.4.2. Driver Related Map Descriptor Parameters

Column Title	Function	Legal Values
Node_Name	Name of Node to fetch data from	One of the node names specified in "Client Node Descriptor" above
Data_Type	Data type	Note 2
Property	The BACnet property to be read	Present_Value
Data_Array_Low_Scale*	Scaling zero in Data Array	-32767 to 32767, 0
Data_Array_High_Scale*	Scaling max in Data Array	-32767 to 32767, 10000
Node_Low_Scale*	Scaling zero in Connected Node	-32767 to 32767, 0
Node_High_Scale*	Scaling max in Connected Node	-32767 to 32767, 100

4.4.3. Timing Parameters

Column Title	Function	Legal Values
Scan_Interval	Rate at which data is polled	0-32000s, 20s

Note 2

AI - ANALOG INPUT	BV - BINARY_VALUE
AO - ANALOG_OUTPUT	MI - MULTI_STATE_INPUT
AV - ANALOG_VALUE	MO - MULTI_STATE_OUTPUT
BI - BINARY_INPUT	MV - MULTI_STATE_VALUE
BO - BINARY_OUTPUT	

4.4.4. Map Descriptor Examples

```
// Client Side Map Descriptors
```

Map_Descriptors								
Map_Descriptor_Name,	Data_Array_Name,	Data_Array_Offset,	Function,	Node_Name,	Data_Type,	Object_ID,	Property,	Scan_Interval
CMD_AI_01,	DA_AI_01,	0,	RDBC,	BCU_01,	AI,	1,	Present_Value,	20.000s
CMD_AI_02,	DA_AI_01,	1,	RDBC,	BCU_01,	AI,	2,	Present_Value,	20.000s
CMD_AI_03,	DA_AI_01,	2,	RDBC,	BCU_01,	AI,	3,	Present_Value,	20.000s
CMD_AO_01,	DA_AO_01,	0,	RDBC,	BCU_01,	AO,	1,	Present_Value,	30.000s
CMD_AO_02,	DA_AO_01,	1,	RDBC,	BCU_01,	AO,	2,	Present_Value,	30.000s
CMD_AO_03,	DA_AO_01,	2,	RDBC,	BCU_01,	AO,	3,	Present_Value,	30.000s
Map_Descriptors								
Map_Descriptor_Name,	Data_Array_Name,	Data_Array_Offset,	Function,	Node_Name,	Data_Type,	Object_ID,	Property,	Scan_Interval
CMD_DI_01,	DA_DI_01,	0,	RDBC,	BCU_01,	DI,	1,	Present_Value,	15.000s
CMD_DI_02,	DA_DI_01,	1,	RDBC,	BCU_01,	DI,	2,	Present_Value,	15.000s
CMD_DI_03,	DA_DI_01,	2,	RDBC,	BCU_01,	DI,	3,	Present_Value,	15.000s
CMD_DO_01,	DA_DO_01,	0,	RDBC,	BCU_01,	DO,	1,	Present_Value,	30.000s
CMD_DO_02,	DA_DO_01,	1,	RDBC,	BCU_01,	DO,	2,	Present_Value,	30.000s
CMD_DO_03,	DA_DO_01,	2,	RDBC,	BCU_01,	DO,	3,	Present_Value,	30.000s

5. Configuring the FieldServer as a BACnet Ethernet Server

For a detailed discussion on FieldServer configuration, please refer to the FieldServer Configuration Manual. The information that follows describes how to expand upon the factory defaults provided in the configuration files included with the FieldServer (See “.csv” files on the driver CD).

This section documents and describes the parameters necessary for configuring the FieldServer to communicate with a BACnet Ethernet Client

The configuration file tells the FieldServer about its interfaces, and the routing of data required. In order to enable the FieldServer for BACnet Ethernet communications, the driver independent FieldServer buffers need to be declared in the “Data Arrays” section, the FieldServer virtual node(s) needs to be declared in the “Server Side Nodes” section, and the data to be provided to the Clients needs to be mapped in the “Server Side Map Descriptors” section. Details on how to do this can be found below.

Note that in the tables, * indicates an optional parameter, with the bold legal value being the default.

5.1. Data Arrays

Section Title		
Data_Arrays		
Column Title	Function	Legal Values
Data_Array_Name	Provide name for Data Array	Up to 15 alphanumeric characters
Data_Format	Provides data format	FLOAT, BIT
Data_Array_Length	Number of Data Objects	1-10,000

Example

```
// Data Arrays

Data_Arrays
Data_Array_Name,      Data_Format,      Data_Array_Length
DA_AI_01,             Float,            200
DA_AO_01,             Float,            200
DA_DI_01,             Bit,              200
DA_DO_01,             Bit,              200
```

5.2. Server Side Connection Descriptors

Section Title		
Connections		
Column Title	Function	Legal Values
Adapter	Adapter Name	N1
Protocol	Specify protocol used	Bacnet_Eth

Example

```
// Server Side Connections
Connections
Adapter,          Protocol      *
N1,              Bacnet_Eth
```

5.3. Server Side Node Descriptors

Section Title		
Nodes		
Column Title	Function	Legal Values
Node_Name	Provide name for node	Up to 32 alphanumeric characters
Node_ID	BACnet station address of physical Server node	1-16777215
Protocol	Specify protocol used	Bacnet_Eth

Example

```
// Server Side Nodes
Nodes
Node_Name,          Node_ID,          Protocol
Virtual_BCU_11,    11,              Bacnet_Eth
```

* Note that no connection information is necessary on Server side.

5.4. Server Side Map Descriptors

5.4.1. FieldServer Specific Map Descriptor Parameters

Column Title	Function	Legal Values
Map_Descriptor_Name	Name of this Map Descriptor	Up to 32 alphanumeric characters
Data_Array_Name	Name of Data Array where data is to be stored in the FieldServer	One of the Data Array names from "Data Array" section above
Data_Array_Offset	Starting location in Data Array	0 to maximum specified in "Data Array" section above
Function	Function of Server Map Descriptor	Server

5.4.2. Driver Specific Map Descriptor Parameters

Column Title	Function	Legal Values
Node_Name	Name of Node to fetch data from	One of the node names specified in "Server Node Descriptor" above
Data_Type	Data type in PLC	Note 2
Object_ID	Address of the object	0, 1, 2, 3, ...
Property	The object property to read	Present value
Units	The object units	See Error! Reference source not found.
Data_Array_Low_Scale*	Scaling zero in Data Array	-32767 to 32767, 0
Data_Array_High_Scale*	Scaling max in Data Array	-32767 to 32767, 100
Node_Low_Scale*	Scaling zero in Connected Node	-32767 to 32767, 0
Node_High_Scale*	Scaling max in Connected Node	-32767 to 32767, 100
Active_Text ²	Specify the Active Text property of the Object	Any legal BACnet ASCII string
Inactive_Text1	Specify the Inactive Text property of the Object	Any legal BACnet ASCII string
Relinquish_Default1	Specify the startup Relinquish_Default Property value for this	Any legal BACnet ASCII string

Note 2

AI - ANALOG_INPUT	BV - BINARY_VALUE
AO - ANALOG_OUTPUT	MI - MULTI_STATE_INPUT
AV - ANALOG_VALUE	MO - MULTI_STATE_OUTPUT
BI - BINARY_INPUT	MV - MULTI_STATE_VALUE
BO - BINARY_OUTPUT	DI - DIGITAL_INPUT
DO - DIGITAL_OUTPUT	

² See the BACnet DFS to determine if a particular object supports this property

	Object	
--	--------	--

5.4.3. Map Descriptor Example

```
// Server Side Map Descriptors
```

Map_Descriptors									
Map_Descriptor_Name,	Data_Array_Name,	Data_Array_Offset,	Function,	Node_Name,	Object_Type,	Object_Instance	Property,	Units,	Relinquish_Default
SMD_AI_01,	DA_AI_01,	0,	Server,	Virtual_BCU_11,	AI,	1,	Present_Value,	Degrees-Fahrenheit,	-
SMD_AI_02,	DA_AI_01,	1,	Server,	Virtual_BCU_11,	AI,	2,	Present_Value,	Degrees-Fahrenheit,	-
SMD_AI_03,	DA_AI_01,	2,	Server,	Virtual_BCU_11,	AI,	3,	Present_Value,	Degrees-Fahrenheit,	-
SMD_AO_01,	DA_AO_01,	0,	Server,	Virtual_BCU_11,	AO,	1,	Present_Value,	percent-relative-humidity,	0
SMD_AO_02,	DA_AO_01,	1,	Server,	Virtual_BCU_11,	AO,	2,	Present_Value,	percent-relative-humidity,	0
SMD_AO_03,	DA_AO_01,	2,	Server,	Virtual_BCU_11,	AO,	3,	Present_Value,	percent-relative-humidity,	0

```
// Server Side Map Descriptors
```

Map_Descriptors									
Map_Descriptor_Name,	Data_Array_Name,	Data_Array_Offset,	Function,	Node_Name,	Object_Type,	Object_Instance,	Property	Relinquish_Default	
SMD_DI_01,	DA_DI_01,	0,	Server,	Virtual_BCU_11,	DI,	1,	Present_Value	-	
SMD_DI_02,	DA_DI_01,	1,	Server,	Virtual_BCU_11,	DI,	2,	Present_Value	-	
SMD_DI_03,	DA_DI_01,	2,	Server,	Virtual_BCU_11,	DI,	3,	Present_Value	-	
SMD_DO_01,	DA_DO_01,	0,	Server,	Virtual_BCU_11,	DO,	1,	Present_Value	0	
SMD_DO_02,	DA_DO_01,	1,	Server,	Virtual_BCU_11,	DO,	2,	Present_Value	0	
SMD_DO_03,	DA_DO_01,	2,	Server,	Virtual_BCU_11,	DO,	3,	Present_Value	0	

Appendix A. Advanced Topics

Appendix A.1. BACnet Object Names

When an external BACnet Client builds a list of Object Names, the BACnet Server Map Descriptor name determines the BACnet Object Name. If the Map Descriptor length is greater than 1, then the Object Name will be suffixed with the index into the Map Descriptor. For example, if the Map Descriptor name is SMD_AI_01 and the length 3, then the Object Names will be SMD_AI_01[0], SMD_AI_01[1] and SMD_AI_01[2].

Appendix A.2. FieldServer implementation of BACnet priority Arrays

When writing to a BACnet Output Object, a write priority value must be specified. When the FieldServer receives the write value, it will be stored to the Map Descriptor Priority Array Table at the specified priority. The Priority Array Table is then scanned and the value with the highest priority is stored to the Data Array location specified by the Map Descriptor.

When a Write “Relinquished” command is received, the value is removed from the Priority Array Table and the next highest value from the Priority Array Table is stored to the Data Array.

If all values have been “Relinquished” from the Priority Array Table, then the Map Descriptors “Relinquish Default” value will be stored to the Data Array.

Appendix A.3. Accessing Priority Array information from other protocol drivers

The Priority Array table and its “In_Use” (or Not Relinquished) state are stored internally to every Map Descriptor, and cannot be accessed directly. If the following data arrays are specified, however, they will maintain an exact copy of the Priority Array Table for the Map Descriptor. Thus the Priority Array Table can be accessed.

Section Title		
Map_Descriptors		
Column Title	Function	Legal Values
DA_Pri_Array	Name of Data Array where the Priority Array Table will be stored. Location 0 is the Relinquish Default value and locations 1 to 16 the different entries of the Priority Array Table.	Up to 16 alphanumeric characters
DA_Pri_Array_Offset	Starting location in Data Array.	1-65535 (17)
DA_Pri_In_Use	Name of Data Array that indicates if a particular Priority Values is in use. Location 0 indicate if the Relinquish Default has been set and locations 1 to 16 indicate if the index is in use (1), or if it has been Relinquished (0).	Up to 16 alphanumeric characters
DA_Pri_In_Use_Offset	Starting location in Data Array.	1-65535 (17)

Appendix B. Troubleshooting

Appendix B.1. Debugging a BACnet connection: Hints and tips

- Disconnect the FieldServer from the BACnet network when transferring BCU images to the BCU.
- Should duplicate object instances be accidentally configured in the FieldServer, the second call of the instance will overwrite the first one. This may result in a BACnet Object being "lost."
- If "Virtual_BCU_..." is not being indicated as the device description for the FieldServer on the BACnet SCADA system, then the FieldServer is not communicating to the SCADA system. If the present value's name is being indicated, but the present value shows question marks, then it is most likely that the Client side of the FieldServer is not communicating.
- If new points are added to the FieldServer it is important to restart the Summit Workstation or BCU, otherwise these new points might not be seen by the FieldServer.
- Poll only the BACnet addresses that exist in the device when communicating with Liebert systems. Polling addresses that are not configured in these systems will cause the connection to fail. The newer versions of Lieberts do not suffer from this problem. Please contact your Lieberts supplier for more information.
- Extra memory is required to store Map Descriptors that have the active/inactive text parameters specified. If the defaults are appropriate, do not specify these parameters. This will save memory and allow more Map Descriptors to be created
-

Appendix B.2. BACnet Specific Statistics

Stat	Description	Resolution
Link Control	A "who-is" link control message was sent or received.	It is normal to receive a few link control messages. If the number is higher than the transmit/receive messages, however, there may be a problem with lost communications..
Unsupported Properties	A request for an unsupported property was received.	This is not an error. BACnet clients often poll all properties of a particular object to determine which properties are supported.
Segmentation Not Supported	Data was requested but the response would have exceeded the maximum size of the APDU and could not be sent using an un-segmented message.	This is not an error - the BACnet client will use a different method to read data from the FieldServer.
Sequence Error	Invoke ID of a reply did not match the Invoke ID of the poll.	You should not see this message. It normally indicates a configuration error.
Write Access Denied	A write to an object was denied.	This typically happens when trying to write to an Input Object that is not Out-Of-Service. It is not possible to write to Input Objects.
Exception Errors	A BACnet Service was denied because it is not supported	This may be a problem on the Client system. Consult the PIC statement to determine what services are supported.

Appendix C. Units

Unit	Variation 1	Variation 2	Variation 3
Amperes	Amps	A	
Bars			
BTUs			
BTUs-per-hour			
btus-per-pound			
btus-per-pound-dry-air			
centimeters			
centimeters-of-mercury			
centimeters-of-water			
cubic-feet			
cubic-feet-per-minute			
cubic-feet-per-seconds			
cubic-meters			
cubic-meters-per-hour			
cubic-meters-per-seconds			
Currency1			
Currency2			
Currency3			
Currency4			
Currency5			
Currency6			
Currency7			
Currency8			
Currency9			
Currency10			
cycles-per-hour			
cycles-per-minute			
days			
degrees-angular			
Degrees-Celsius	Deg-C	Deg_C	
degrees-celsius-per-hour			
degrees-celsius-per-minute			
Degrees-days-Celsius			
Degrees-days-Fahrenheit			
Degrees-Fahrenheit	Deg-F	Deg_F	
degrees-fahrenheit-per-hour			
degrees-fahrenheit-per-minute			
Degrees-Kelvin	Deg-K	Deg_K	
degrees-phase			
delta-degrees-fahrenheit			
delta-degrees-kelvin			
feet			
feet-per-minute			
feet-per-second			
foot-candles			
grams-water-per-kg-dry-air			
hectopascals			
Hertz	Hz		
Horsepower	HP		
hours			

Unit	Variation 1	Variation 2	Variation 3
imperial-gallons			
imperial-gallons-per-min			
inches			
inches-of-mercury			
inches-of-water			
Joules			
joules-per-degree-kelvin			
joules-per-kilogram-degree-kelvin			
joules-per-kilogram-dry-air			
Kilograms	Kg		
kilograms-per-hour			
kilograms-per-minute			
kilograms-per-second			
Kilohertz	KHz		
kilohms			
Kilojoules			
kilojoules-per-kilogram			
kilometers-per-hour			
Kilopascals			
kilovolt-amperes	kilovolt-amps	KVA	
kilovolt-amperes-reactive	KVAR		
kilovolts			
kilowatt-hour-per-square-foot			
kilowatt-hour-per-square-meter			
kilowatt-hours	KWh		
kilowatts	KWh		
liters			
liters-per-hour			
liters-per-minute			
liters-per-second			
lumens			
luxes			
Megahertz	MHz		
megajoules			
megajoules-per-square-foot			
megajoules-per-square-meter			
megavolt-amperes	megavolt-amps		
Megavolt-amperes-reactive	MVAR		
megavolts			
megawatts	MW		
megohms			
meters			
meters-per-second			
miles-per-hour			
milliamperes	milliamps		
millibars			
millimeters			
millimeters-of-mercury			
Millivolts			
Milliwatts			
minutes			
months			

Unit	Variation 1	Variation 2	Variation 3
No-Units	No Units	No_Units	None
ohms			
parts-per-billion			
parts-per-million			
Pascals			
Percent			
percent-obscuration-per-foot			
percent-obscuration-per-meter			
percent-per-second			
percent-relative-humidity	% RH	Percent RH	Percent RH
Per-hour			
per-minute			
per-second			
pounds-force-per-square-inch	PSI	pounds-force-per-sq-inch	
Pounds-mass			
pounds-mass-per-hour			
pounds-mass-per-minute			
pounds-mass-per-second			
Power-Factor	PF		
psi-per-degrees-fahrenheit			
radians			
revolutions-per-minute			
seconds	Secs	S	
square-centimeters			
square-feet			
square-inches			
square-meters			
Therms			
ton-hours			
Tons			
Tons-refrigeration			
US-gallons	Gallons		
us-gallons-per-minute	GPM		
Volt-Amperes	Volt-Amps	VA	
volt-amperes-reactive	VAR		
Volts	Voltage		
watt-hours	Wh		
Watts	W		
watts-per-square-foot			
watts-per-square-meter			
watts-per-square-meter-degrees-kelvin			
weeks			
years			

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